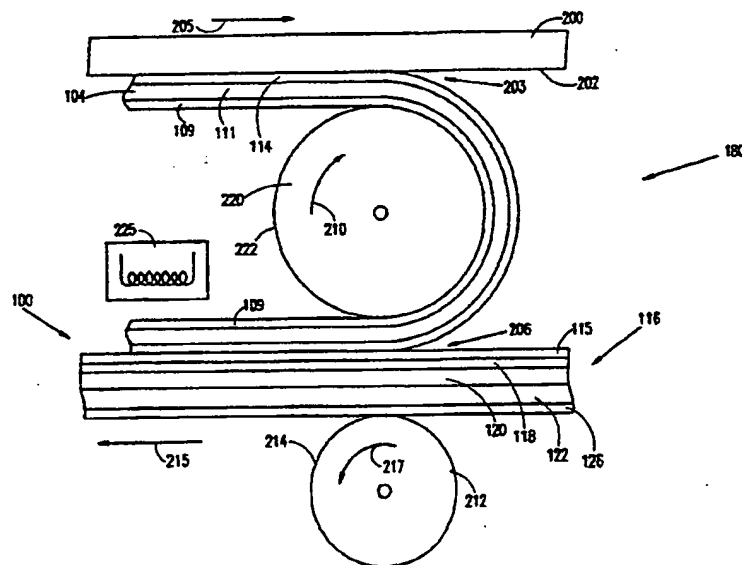


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(54) Title: INTERMEDIATE TRANSFER BLANKET AND METHOD OF PRODUCING THE SAME



(57) Abstract

A multi-layered image transfer blanket (100) and a method of producing same, including a body portion (116) and an image transfer portion (104), the image transfer portion (104) having an image transfer surface and a back surface, comprising forming the image transfer portion (104) on a carrier substrate (200) and transferring the image transfer portion onto the body portion (116) such that the back surface of the image transfer portion faces the body portion. Preferably, the image transfer portion is formed on the carrier substrate such that the back surface of the image transfer portion faces the carrier substrate.

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1 INTERMEDIATE TRANSFER BLANKET AND METHOD OF PRODUCING THE SAME

2

3

FIELD OF THE INVENTION

4 The present invention relates to improved intermediate
5 transfer blankets, especially suited for transfer of liquid
6 toner images, and methods of producing such blankets.

7

8

BACKGROUND OF THE INVENTION

9 The use of an intermediate transfer member in
10 electrostatic imaging is well known.

11 Various types of intermediate transfer members are known
12 and are described, for example in U.S. Patents 3,862,848,
13 4,684,238, 4,690,539 and 4,531,825, the specifications of all
14 of which are incorporated herein by reference.

15 Belt-type intermediate transfer members for use in
16 electrophotography are known in the art and are described,
17 inter alia, in U.S. Patents 3,893,761, 4,684,238 and
18 4,690,539, the specifications of all of which are incorporated
19 herein by reference.

20 The use of intermediate transfer members and members
21 including transfer blankets, for offset ink printing, is also
22 well known. Such blankets have characteristics which are
23 suitable for ink transfer but they are generally not usable,
24 per se, for liquid toner imaging.

25 Multi-layered intermediate transfer blankets for toner
26 imaging are known in the art. Generally, such blankets include
27 a thin, multi-layered, image transfer portion and a base (or
28 body) portion which supports the image transfer portion and
29 provides the blanket with resilience during contact with an
30 imaging surface and/or a final substrate. While the process
31 for producing the image transfer portion is a relatively clean
32 process, the base portion is generally not compatible with
33 such clean processes.

34 Mechanisms for continuous replacement of an imaging
35 blanket are known in the art. Such a mechanism is described,
36 for example in Japanese Publication JP 5046037, published
37 February 26, 1993, wherein a continuous sheet of transfer-
38 blanket material is rolled-up in a cassette, inside a drum,

1 and a premeasured length of the blanket material is stretched
2 circumferentially on the surface of the drum. When the
3 stretched out length of blanket requires replacement, the used
4 portion of the blanket is drawn into a take-up cassette,
5 inside the drum, and a new portion of the blanket is stretched
6 between the two cassettes. It should be noted that the length
7 of transfer-blanket material in the cassettes is limited by
8 the thickness of the continuous blanket and the available
9 space within the drum.

10 US patent 4,074,001 describes a fixing roller for
11 electrophotography which has a 3 mm coating of a mixture of
12 diorganopolysiloxanes terminated at both chain ends with
13 diorganohydroxysilyl groups bonded to terminal silicone atoms
14 (a condensation type silicone), diorganopolysiloxanes
15 terminated at both chain ends with trialkysilyl groups (a
16 substantially unreactive silicone oil), a minor part of an
17 alkoxysilane catalyst and various amounts of fillers. This
18 material vulcanizes, in the 3 mm thickness, at room
19 temperature.

20

SUMMARY OF THE INVENTION

21 It is an object of an aspect of the present invention to
22 provide an improved image transfer blanket for use as part of
23 an image transfer member in imaging apparatus, especially in
24 image forming apparatus using electrostatically charged toner.

25 It is an object of an aspect of the present invention to
26 provide an improved method and apparatus for producing a
27 multi-layered image transfer blanket.

28 It is an object of an aspect of the present invention to
29 provide an image transfer blanket having a base portion and an
30 image transfer portion, wherein the image transfer portion is
31 movable relative to the base portion.

32 It is an object of an aspect of the present invention to
33 provide a mechanism for replacing the image transfer portion
34 of the image transfer blanket without replacing the base
35 portion of the blanket.

36 It is a further object of some aspects of the invention
37 to provide an improved release layer for intermediate transfer
38 members and blankets.

1 There is thus provided, in accordance with a preferred
2 embodiment of the invention, a method of producing a multi-
3 layered image transfer blanket including a body portion and an
4 image transfer portion, the image transfer portion having an
5 image transfer surface and a back surface, comprising:

6 forming the image transfer portion on a carrier
7 substrate; and

8 transferring the image transfer portion onto the body
9 portion such that the back surface of the image transfer
10 portion faces the body portion.

11 Preferably the image transfer portion is formed on the
12 carrier substrate such that the back surface of the image
13 transfer portion faces the carrier substrate.

14 In a preferred embodiment of the invention transferring
15 the image transfer portion comprises:

16 transferring the image transfer portion to a moving
17 carrier surface, such that at least a portion of the image
18 transfer surface is in contact with the moving surface; and

19 laminating the image transfer portion onto the body
20 portion such that the back surface of the image transfer
21 portion faces the body portion.

22 Preferably the method comprises curing at least one of
23 the layers in said multi-layered blanket after transferring
24 the image transfer portion. Preferably, the image transfer
25 blanket comprises a polymer layer, preferably a conducting
26 layer, interfacing the back surface of the image transfer
27 portion and curing at least one of the layers comprises curing
28 the polymer layer after laminating the image transfer portion
29 onto the body portion.

30 In one preferred embodiment of the invention the polymer
31 layer is part of the body portion. Additionally or
32 alternatively, the polymer layer is part of the image transfer
33 portion.

34 In a preferred embodiment of the invention the image
35 transfer portion comprises a release layer at the image
36 transfer surface and a conforming layer and wherein curing at
37 least one layer comprises curing the release layer and the
38 conforming layer before laminating the image transfer portion

1 to the body portion. In an alternative preferred embodiment of
2 the invention the release layer and the conforming layer are
3 cured after laminating the image transfer portion to the body
4 portion.

5 In a preferred embodiment of the invention forming the
6 image transfer portion comprises coating the carrier substrate
7 with a conforming layer.

8 In a preferred embodiment of the invention forming the
9 image transfer portion comprises coating the carrier substrate
10 with a barrier layer.

11 In a preferred embodiment of the invention forming the
12 image transfer portion comprises coating the carrier substrate
13 with a conductive layer.

14 In a preferred embodiment of the invention the conforming
15 layer comprises a plurality of layers of different hardnesses.

16 In a preferred embodiment of the invention forming the
17 image transfer portion comprises overcoating the conforming
18 layer with a release layer, preferably comprising a layer of
19 condensation type silicone.

20 There is further provided in accordance with a preferred
21 embodiment of the invention an image transfer member suitable
22 for the transfer of toner images and having an outer release
23 coating of a condensation type silicone.

24 Preferably the release layer has a thickness of less than
25 1 mm, more preferably less than 500 micrometers, even more
26 preferably less than 100 micrometers and most preferably
27 between 3 and 15 micrometers thick.

28 Further, the release layer preferably has less than 4%
29 filler, more preferably less than 1% filler, even more
30 preferably less than 0.1% filler.

31 In a preferred embodiment of the invention the outer
32 release layer contains less than 10% silicone oil, more
33 preferably less than 5% silicone oil, more preferably less
34 than 1% silicone oil, most preferably little or no silicone
35 oil.

36 In a preferred embodiment of the invention the outer
37 release layer contains added crosslinker.

1 In a preferred embodiment of the invention the outer
2 release layer contains added catalyst.

3 In a preferred embodiment of the invention the outer
4 release layer contains added conductive material.

5 In a preferred embodiment of the invention adhesion of
6 the outer release coating to the image transfer member is
7 enhanced utilizing primer.

8 There is further provided, in accordance with a preferred
9 embodiment of the invention, apparatus for producing a multi-
10 layered image transfer blanket including a body portion and an
11 image transfer portion, the image transfer portion having an
12 image transfer surface and a back surface, comprising:

13 a carrier substrate having the image transfer portion
14 formed thereon such that the back surface of the image
15 transfer portion faces the carrier substrate and is releasable
16 therefrom; and

17 a moving carrier surface, in contact with a portion of
18 the image transfer surface, which receives the image transfer
19 portion from the carrier substrate, at a first transfer
20 region, and laminates the image transfer portion onto the body
21 portion, at a second transfer region, with the back surface of
22 the image transfer portion facing the body portion.

23 Preferably, the apparatus further comprises a curing
24 device which cures at least one of the layers in said multi-
25 layered blanket.

26 There is further provided, in accordance with a preferred
27 embodiment of the invention, an image transfer blanket
28 comprising:

29 a transfer surface adapted to receive already formed
30 images; and

31 a conforming layer substantially immediately beneath the
32 release surface which comprises a plurality of sub-layers each
33 having a Shore A hardness of less than 80, preferably less
34 than 70, more preferably less than 60.

35 Preferably, the sub-layers comprise at least two sub-
36 layers, a relatively harder one of said sub-layers being
37 situated between is between the release surface and a
38 relatively softer one of said sub-layers. Preferably, the

1 relatively softer sub-layer has a Shore A hardness of less
2 than 42, less than 35, or less than 25. Preferably, the
3 relatively harder sub-layer has a Shore A hardness of greater
4 than 42, or greater than 50. In some preferred embodiments of
5 the invention the ratio of the thickness of the relatively
6 harder sub-layer to the thickness of the relatively softer
7 sub-layer is about 1:4.

8 There is further provided an image transfer blanket
9 comprising:

10 a body portion including a layer of resilient material;
11 and

12 a multi-layered transfer portion having an image transfer
13 surface and including a supporting base layer which is formed
14 of a substantially non-compliant material,

15 wherein the supporting base layer of the transfer portion
16 interfaces the body portion.

17 There is further provided in accordance with a preferred
18 embodiment of the invention a method of producing a multi-
19 layered image transfer blanket comprising:

20 forming a multi-layered image transfer portion having an
21 image transfer surface and a supporting base layer, the base
22 layer being formed of a substantially non-compliant material;
23 and

24 attaching the image transfer portion to a body portion
25 including a layer of substantially resilient material,

26 wherein the supporting base layer of the transfer portion
27 interfaces the body portion.

28 There is further provided, in accordance with a preferred
29 embodiment of the invention an intermediate transfer member,
30 which receives a toner image from an imaging surface and from
31 which it is subsequently transferred, comprising:

32 a drum; and

33 an image transfer blanket mounted on the drum, the image
34 transfer blanket comprising:

35 a body portion including a layer of resilient material;
36 and

37 a multi-layered transfer portion having an image transfer
38 surface which receives the toner image and a supporting base

1 layer which is formed of a substantially non-compliant
2 material,

3 wherein the supporting base layer of the transfer portion
4 interfaces the body portion.

5 Preferably, the supporting base layer comprises a layer
6 of Kapton.

7 There is further provided an intermediate transfer
8 member, which receives a toner image from an imaging surface
9 and from which it is subsequently transferred, comprising:

10 a drum;

11 a resilient blanket body mounted circumferentially on the
12 surface of the drum and having a functional length;

13 a sheet of image transfer material having first and
14 second ends and having a length equal to at least twice the
15 functional length of the blanket body;

16 a transfer material supply member associated with the
17 first end of the sheet; and

18 a transfer material take-up member associated with the
19 second end of the sheet,

20 wherein an appropriate length of the sheet is stretched
21 between the supply member and the take-up member, over the
22-functional length of the blanket body.

23 Preferably, a predetermined length of used-up sheet is
24 taken-up by the take-up member and replaced with approximately
25 the same length of unused sheet which is supplied the supply
26 member.

27 There is further provided a carrier substrate having
28 formed thereon a multi-layered image transfer arrangement, the
29 image transfer arrangement comprising a back surface and an
30 image transfer surface, wherein the back surface of the image
31 transfer arrangement faces the carrier substrate and is
32 removably attached thereto.

1 BRIEF DESCRIPTION OF THE DRAWINGS

2 The present invention will be understood and appreciated
3 more fully from the following detailed description, taken in
4 conjunction with the drawings in which:

5 Fig. 1 is a simplified cross-sectional illustration of an
6 image transfer member, including a multi-layered image
7 transfer blanket mounted on a drum, in accordance with a
8 preferred embodiment of the present invention;

9 Figs. 2A and 2B are respective top and side views of the
10 image transfer blanket of Fig. 1, in accordance with a
11 preferred embodiment of the present invention;

12 Fig. 2C shows details of the multi-layered construction
13 of the image transfer blanket of Figs. 2A and 2B, in
14 accordance with one, preferred, embodiment of the present
15 invention;

16 Fig. 3 is a schematic illustration of apparatus for
17 producing a multi-layered image transfer blanket, constructed
18 and operative in accordance with a preferred embodiment of the
19 present invention;

20 Fig. 4 is a simplified, schematic illustration of an
21 image transfer blanket having an image transfer portion,
22 constructed in accordance with another, preferred, embodiment
23 of the present invention; and

24 Fig. 5 is a simplified cross-sectional illustration of an
25 image transfer member, including the image transfer blanket of
26 Fig. 4 mounted on a drum and apparatus for renewing the image
27 transfer portion of the image transfer blanket, constructed
28 and operative in accordance with a preferred embodiment of the
29 invention.

1 DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

2 Reference is now made to Fig. 1 which is a simplified
3 cross-sectional illustration of an image transfer member 30,
4 including a multi-layered image transfer blanket 100 mounted
5 on a drum 102, in accordance with a preferred embodiment of
6 the present invention. Image transfer member 30 may, for some
7 embodiments of the invention, be any suitable intermediate
8 transfer member having a multilayered transfer portion such as
9 those described below or in US Patents 5,089,856 or 5,047,808
10 or in PCT Application PCT/NL 95/00188, filed June 6, 1995, the
11 disclosures of which are incorporated herein by reference and
12 by other structures known in the art. As is known in the art,
13 member 30 is maintained at a suitable voltage and temperature
14 for electrostatic transfer of a toner image thereto from an
15 image bearing surface, such as a photoreceptor surface. The
16 image is preferably transferred from intermediate transfer
17 member 30 onto a final substrate (not shown), such as paper,
18 preferably by heat and pressure. For the preferred toner
19 described in PCT/NL 95/00188, an image temperature of about
20 95°C at the inception of fusing is preferred.

21 Certain aspects of the present invention, especially the
22 manner in which transfer blanket 100 is mounted on drum 102,
23 are shown and described by way of example only and may vary in
24 accordance with specific requirements and design
25 considerations. Other preferred methods of mounting the
26 transfer blanket on the drum are shown in the aforementioned
27 application number PCT/NL 95/00188.

28 As known in the art, a plurality of single color images
29 are preferably sequentially transferred, in mutual alignment,
30 to the surface of an image transfer portion 104 of image
31 transfer blanket 100, by sequential imaging cycles. When all
32 of the desired images have been transferred to image transfer
33 blanket 100, the complete multi-color image is transferred
34 from transfer member 30 to the final substrate. Alternatively,
35 each single color image may be separately transferred to the
36 substrate via the intermediate transfer member, as known in
37 the art.

1 Reference is now made to Figs. 2A, 2B and 2C which
2 schematically illustrate a preferred embodiment of image
3 transfer blanket 100. As shown most clearly in Fig. 2C, image
4 transfer portion 104 comprises a release layer 109 which is
5 outermost on the blanket when it is mounted on drum 102.
6 Underlying layer 109 is a conforming layer 111 preferably of a
7 soft elastomer, preferably of polyurethane or acrylic and
8 preferably having a Shore A hardness of less than about 65,
9 more preferably, less than about 55, but preferably more than
10 about 35. A suitable hardness value is between about 42 and
11 about 45. Alternatively, layer 11 may have sub-layers of
12 varying hardness, as described below.

13 A thin barrier layer for solvents and/or gases 114 lies
14 between layer 111 and an underlying conductive layer 115 for
15 some embodiments of the invention. In general, the order of
16 layers 114 and 115 may be reversed. Conductive layer 115
17 overlays a blanket body 116 comprising a top layer 118, a
18 compressible layer 120 and a fabric layer 122. In a preferred
19 embodiment of the invention, as described in more detail
20 below, top layer 118 is conductive and conductive layer 115
21 may be omitted.

22 Underlying the fabric layer there may be an adhesive
23 layer 126 which is in contact with drum 102. Alternatively,
24 layer 126 is a very soft, smooth, layer.

25 Drum 102 is preferably heated by an internal halogen lamp
26 heater or other heater to aid transfer of the image to the
27 release layer 109 and therefrom to the final substrate, as is
28 well known in the art. Other heating methods, or no heating at
29 all, may also be used in the practice of the invention. The
30 degree of heating will depend on the characteristics of the
31 toner and/or ink used in conjunction with the invention.

32 As shown in Figs. 2A and 2B, mounting fitting 106
33 comprises an elongate electrically conducting bar 108, for
34 example of a metal such as aluminum, formed with a series of
35 L-shaped mounting legs 110 (in the form of finger-like
36 extensions) which are also conducting, preferably of the same
37 material as bar 108, and preferably formed integrally
38 therewith. In particular, bar 108 is formed, in one preferred

1 embodiment, with a slot into which the end of layered part of
2 blanket 100 is inserted. Preferably, the end of the layered
3 part which is inserted into the mounting bar does not include
4 release layer 109, conforming layer 111 and barrier layer 114,
5 whereby conducting layer 115 is exposed and is therefore in
6 electrical contact with bar 108.

7 Alternatively, if layer 118 is conducting or layer 115 is
8 made thick enough (preferably more than 40 micrometers thick)
9 the slot can be formed with sharp internal projections which
10 pierce the outer layers of the blanket and contact conducting
11 layer 115 or conducting top layer 118.

12 Optionally, each of the layers beneath conducting layer
13 115 may be partially conducting (for example, by the addition
14 of conductive carbon black or metal fibers) and the adhesive
15 (or very soft and smooth) layer 126 may be conductive, such
16 that current flows, additionally or alternatively, directly
17 from the drum surface to the conducting layer. In this case
18 layer 115 may generally be omitted.

19 Optionally, the conforming layer and/or the release layer
20 are made somewhat conductive (preferably between 10^6 and 10^{12}
21 ohm-cm, more preferably, between 10^9 and 10^{11} ohm-cm) by the
22 addition of carbon black or between 1% and 10% of anti-static
23 compounds such as CC-42 (Witco).

24 For the purposes of most aspects of the present
25 invention, the structure and method of attachment of the
26 blanket to drum 30 is not relevant, per se, to the invention.

27 In one preferred embodiment of the invention, fitting 106
28 is formed of a single sheet of metal, wherein the legs are
29 partially cut from the metal which is bent into a U-shape to
30 form the slot into which the layered portion is inserted.
31 After insertion, the outer walls of the slot are forced
32 against the layered portion to secure the layered portion in
33 the slot and, optionally, to pierce the outer surface of the
34 blanket and contact the conductive layer. The partially cut
35 out portion is bent to form the mounting legs.

36 In the preferred embodiment of the invention, drum 102 is
37 maintained at a potential suitable for transferring images to
38 the intermediate transfer member, for example at a negative

1 voltage of 500 volts, which voltage is applied, via mounting
2 fitting 106 to conductive layer 115 or 118. Thus, the source
3 of transfer voltage is very near the outer surface of transfer
4 portion 104 which allows for a lower transfer potential on the
5 drum.

6 Apart from differences which will be appreciated from the
7 descriptions herein, the multi-layered blanket 100 of the
8 present invention is generally similar to that described in
9 PCT/NL 95/00188, except for additional preferred embodiments
10 as described herein. However, the multi-layered blanket of the
11 present invention is produced by a new process, as described
12 below.

13 It is appreciated that blanket body 116 includes
14 components which may contaminate at least some of the layers
15 in the image transfer portion during production of the
16 blanket. For example, small particles from blanket body 116,
17 which is generally formed of relatively unclean materials, may
18 break off the body portion and contaminate the relatively
19 clean layers of transfer portion 104. This may result in low
20 transfer efficiency and poor imaging quality. Therefore, in a
21 preferred embodiment of the present invention, blanket body
22-116 and image transfer portion 104 are formed separately. The
23 separately formed image transfer portion is consequently
24 laminated onto the blanket body, as described in detail below
25 with reference to Fig. 3. Conducting layer 115 may be coated
26 directly on blanket body 116 or laminated thereon together
27 with the other layers of image transfer portion 104, as
28 described below. Alternatively, layer 118 is conducting and
29 layer 115 is omitted. Curing of the different layers in the
30 multi-layered blanket may be performed before, after or during
31 lamination of the two portions of the blanket.

32 Reference is now made also to Fig. 3 which schematically
33 illustrates apparatus 180 for forming multi-layered image
34 transfer blanket 100, constructed and operative in accordance
35 with a preferred embodiment of the invention.

36 In a preferred embodiment of the invention, the con-
37 struction of blanket body 116 is generally similar to that
38 described in PCT/NL 95/00188. One suitable body is MCC-1129-02

1 manufactured and sold by Reeves SpA, Lodi Vecchio (Milano),
2 Italy. Other preferred blanket types are described in US
3 Patents 5,047,808; 4,984,025; 5,335,054 and PCT publications
4 WO 91/03007; WO 91/14393; WO 90/14619; and WO 90/04216, which
5 are incorporated herein by reference, and in PCT/NL 95/00188.
6 Body portion 116 includes fabric layer 122, preferably formed
7 of woven NOMEX material having a thickness of about 200
8 micrometers, compressible layer 120, preferably comprising
9 about 400 micrometers of saturated nitrile rubber loaded with
10 carbon black to increase its thermal conductivity. Layer 120
11 preferably contains small voids (about 40 - 60 % by volume)
12 and top layer 118 is preferably formed of the same material as
13 the compressible layer, but without voids. Blanket body 116
14 can be produced using production methods as are generally used
15 for the production of offset printing blankets for ink offset
16 printing.

17 Blanket body 116 is preferably sized to a relatively
18 exact thickness by abrading portions of the surface of top
19 layer 118. A preferred thickness for the finished body 116 is
20 about 700 micrometers, although other thicknesses are useful,
21 depending on the geometry of the printing system in which it
22 is used and the exact materials used in the blanket body.

23 The fabric side of blanket body 116 may be coated with a
24 30 micrometer thick coating of silicone based adhesive
25 (preferably, Type Q2-7566 manufactured by Dow Corning). The
26 adhesive is covered with a sheet of mylar coated with a
27 fluorosilicone material, such as DP 5648 Release Paper (one
28 side coat) distributed by H.P. Smith Inc., Bedford Park, IL.
29 This adhesive is characterized by its good bond to the surface
30 of drum 102 and its resistance to the carrier liquid used in
31 the liquid toner. The blanket may be removed from drum 102,
32 when its replacement is desired, by cutting the blanket along
33 the edge of fitting 106 and removing the blanket and fitting.

34 An adhesive is preferably used to assure good thermal
35 contact between the back of the blanket and the drum on which
36 it is mounted. A silicone adhesive is preferred since
37 adhesives normally used in attachment of blankets to drums in
38 the printing art deteriorate under the heat which is generated

1 in the underlying drum in the preferred apparatus. While the
2 temperature of the drum varies, depending on the thermal
3 resistance of the blanket and the desired surface temperature
4 of the blanket (which in turn depends on the toner used in the
5 process and the details of transfer of the toner to the final
6 substrate), the drum temperature may reach 80°C, 100°C, 120°C
7 or 150°C or more.

8 As an alternative to, or additional to, the adhesive
9 layer 126, a very soft conforming layer may be used at the
10 back of the blanket. A soft layer of this type will allow for
11 good thermal contact between the blanket and the heated drum
12 102 so that the temperature of the drum need not be excessive
13 in order for the outer surface of the blanket to reach its
14 operating temperature. Furthermore, such a soft layer,
15 especially if it is very soft, will cause the blanket to
16 "cling" to the drum obviating the use of adhesive under
17 certain circumstances. Furthermore, when the blanket is
18 replaced there is no adhesive residue on the drum to be
19 removed.

20 A very soft layer may be produced by the following
21 method:

22 1) 100g of Hi-Temp 4051 EP (Zeon) acrylic resin is mixed
23 with 2g NPC-50 crosslinker (Zeon) and 3g sodium stearate and
24 dissolved in toluene to give a solution of 15% non-volatile
25 solids. Optionally, up to about 40g of carbon black Pearls 130
26 (Cabot) is added.

27 2) A thin layer of the solution is coated onto release
28 coated mylar and dried. This process is repeated several times
29 until a thickness of preferably 20-30 micrometers is achieved.

30 3) The uncured resin is laminated to the adhesive layer
31 of a blanket produced in accordance with the invention, or
32 directly to the fabric layer. This step is preferably carried
33 out prior to the cure of the release layer.

34 4) The laminated structure is cured together with the
35 release layer and the release coated mylar is removed.

36 The very soft conforming layer has a Shore A hardness of
37 about 20-24 without carbon black and about 40-45 with carbon
38 black. Softer materials are also suitable; however,

1 substantially harder materials do not adhere well to the drum
2 surface. Optionally, the trailing end of the blanket is not
3 coated with the very soft layer. The trailing edge is coated
4 with an adhesive to improve adhesion between this portion and
5 the drum or other surface to which it is attached. This is
6 especially desirable when somewhat harder materials are used
7 for the very soft layer.

8 The acrylic material may be replaced by other soft
9 elastomer materials such as soft polyurethane or nitrile
10 rubber. Other heat improving additives which have a smaller
11 effect on the hardness of the final product may be used
12 instead of carbon black, such as Fe_2O_3 or alpha aluminum
13 oxide.

14 Top layer 118 is preferably coated with a sub-micron
15 layer of primer before being coated with additional layers. A
16 preferred primer is Dow Corning 1205 Prime Coat. The type of
17 primer depends on the properties of the top layer and of the
18 conductive layer. Preferably, 0.3 micron of primer is coated
19 onto a clean top layer with a No. 0 bar in a wire-rod coating
20 apparatus and is allowed to dry before applying the conductive
21 layer.

22 Conductive layer 115 is preferably formed of an acrylic
23 rubber loaded with conductive carbon black. The conductive
24 layer is formed by first compounding 300 grams of Hytemp
25 4051EP (Zeon Chemicals) with 6 grams of Hytemp NPC 50 and 9
26 grams of sodium stearate in a two-roll mill for 20 minutes;
27 and then dissolving 150 grams of the compounded material in
28 2000 grams of methyl ethyl ketone (MEK) by stirring for 12
29 hours at room temperature.

30 48 grams of conductive carbon black, such as, for
31 example, Printex XE2 (Degussa) are added to the solution and
32 the mixture is ground in a 01 attritor (Union Process) loaded
33 with 3/16" steel balls. Grinding proceeds at 10°C for 4 hours
34 after which time the material is diluted by the addition of
35 MEK to a concentration of 7.5-8% solids and discharged from
36 the grinder in the form of a conductive lacquer.

37 This material is coated onto layer 118 to a thickness of
38 preferably 1-3 micrometers.

1 In an alternate preferred embodiment of the invention,
2 where a thicker conductive layer is desired for attachment to
3 bar 108 by way of piercing elements, layer 118 is made
4 conductive and layer 115 is omitted. For this embodiment a
5 different conductive formulation is preferably used, which
6 formulation is prepared as follows:

7 1) 100g of Hi-Temp 4051 EP (Zeon) acrylic resin and 15-25
8 grams of Printex XE-2 carbon black (Degussa) are mixed on an
9 unheated two-roll mill or Bumbury mixer for 2-4 minutes.

10 2) 2g NPC-50 crosslinker (Zeon) and 3g sodium stearate
11 are added to the mixture on the two roll mill and mixing is
12 continued for 4-10 minutes. The mill is kept cool to avoid
13 premature polymerization of the acrylic resin.

14 3) The resulting mixture is dissolved and dispersed in
15 toluene are to give a mixture containing 17% to about 30% non-
16 volatile solids.

17 4) The resultant mixture is progressively filtered, with
18 a final filtering stage of 50 micrometers.

19 Layer 120 is overcoated with about 100 micrometers of the
20 resulting material and is dried at up to 100°C for a few
21 minutes. Several layers of this material are added until the
22 desired thickness of 100 micrometers is reached. This layer is
23 sized as described above. The resulting conductive layer
24 preferably has a resistance of 15K ohms per square to 50K ohms
25 per square.

26 An additional coating of primer may be added over the
27 conductive lacquer or the conductive top layer 118 (except for
28 the portion which is to be inserted into bar 108) before the
29 remaining layers, i.e. the layers of image transfer portion
30 104, are laminated onto blanket body 116. Conductive layer 115
31 is preferably not cured until after lamination with portion
32 104, as described below.

33 The resistance of the conductive layer should preferably
34 be more than about 15-20K ohms per square and preferably less
35 than about 50K ohms per square. This value will depend on the
36 resistivity of the layers above the conducting layer and on
37 the aspect ratio of the blanket. In general, the resistance
38 should be low enough so that the current flowing on the

1 conducting layer (to supply leakage current through the
2 overlying layers) does not cause a substantial variation of
3 voltage along the surface of the blanket. The resistance of
4 the conducting layer and, more importantly, the resistance of
5 the overlying layers control the current flowing through the
6 overlying layers. Generally speaking, the conductive layer has
7 a relatively low resistance and resistivity, the conforming
8 layer (layer 111) has a higher resistivity and the overlying
9 release layer (layer 109) has a still higher resistivity.

10 As shown in Fig. 3, image transfer portion 104 is
11 preferably formed on a carrier substrate 200 independently of
12 the formation of blanket body 116 as described above. The
13 utilized surface 202 of substrate 200 should be releasable
14 from conforming layer 111, barrier layer 114 or conducting
15 layer 115 (depending on whether barrier layer 114 and/or
16 conductive layer 115 are included in image transfer portion
17 104), because portion 104 is to be subsequently removed from
18 substrate 200. Furthermore, the releasability of substrate 200
19 from portion 104 should be higher than the releasability of
20 release layer 109 from conforming layer 111, to ensure that
21 the layers in portion 104 are collectively releasable from
22 substrate 200. In a preferred embodiment of the invention,
23 substrate 200 is a sheet of metalized, preferably aluminized,
24 polyester having a thickness of between 100 micrometers and
25 175 micrometers. This material provides substrate 200 with the
26 desired release and support qualities. It should be
27 appreciated, however, that other materials may be equally
28 suitable or more suitable for providing the desired qualities
29 of substrate 200.

30 Barrier layer 114 is preferably included in image
31 transfer portion 104 in order to isolate the other layers in
32 the image transfer portion from body portion 116, when
33 transfer portion 104 is subsequently integrated with body
34 portion 116, as described below. Such isolation may be
35 required because blanket body 116 may contain materials such
36 as anti-oxidants, anti-ozonants or other additives which may
37 migrate through the upper layers of the blanket, for example
38 as a gas when the blanket is heated during the imaging process

1 and/or in the presence of carrier liquid such as Isopar L. The
2 barrier layer should be substantially impervious to such
3 materials in the blanket body which may migrate and/or to the
4 carrier liquid which is used by the imaging apparatus. If this
5 layer is omitted, under certain circumstances the additive
6 materials can cause deterioration of the photoreceptor used by
7 the imaging apparatus. In particular, it was found that the
8 imaging process may become humidity dependent.

9 In a preferred embodiment of the invention, a 4-11
10 micrometer layer of polyvinyl alcohol (88% hydrolyzed) is
11 coated onto surface 202 of substrate 200.

12 Polyvinyl alcohol, 88% hydrolyzed, having an average
13 molecular weight preferably between 85,000 and 145,000
14 (Aldrich Chemical Co. Inc., Milwaukee, WI) is dissolved in
15 water at 90°C by continuously stirring the mixture in a reflux
16 system for 30 minutes. After 30 minutes, a quantity of ethanol
17 equal to twice the quantity of water is added to the solution,
18 the resulting polyvinyl alcohol concentration being preferably
19 less than 10%. Higher concentration solutions can be used;
20 however, they give a more viscous solution which is hard to
21 spread evenly.

22 The solution can be deposited on surface 202 of substrate
23 200 using a fine wire rod or knife inclined at 30-45° to the
24 direction of movement of the knife or body. The solvent is
25 evaporated either by drying at room temperature or by blowing
26 hot air on the layer.

27 One or more coating passes are employed to give the
28 required thickness.

29 Too thin a layer will subsequently result in some
30 penetration of material from body 116 into the layers of
31 portion 104, which is correlated with reduced transfer
32 efficiency from the photoreceptor to the intermediate transfer
33 blanket. This reduced transfer efficiency is believed to be
34 caused by photoreceptor deterioration. While four micrometers
35 of material appears to be sufficient to avoid leaching, a
36 somewhat thicker layer is preferably used.

37 Other barrier materials and other thicknesses may be used
38 depending on the carrier liquid used for the toner or the

1 gasses omitted by body 116. Other barrier materials may
2 require lesser or greater thickness depending on their
3 resistance to the carrier liquid or the gasses released by
4 body 116. Alternatively, if body 116 resists leaching by the
5 carrier liquid or does not contain materials which are
6 released (especially when body 116 is heated) or any anti-
7 oxidants and/or anti-ozonants, layer 114 may be omitted.

8 In a preferred embodiment of the invention, barrier layer
9 114 on substrate 200 is overcoated with soft, conforming,
10 layer 111, formed of polyurethane or a material similar to the
11 material of the very soft layer which is optionally used for
12 layer 126, as described above. Layer 111 is formed by the
13 following process, in accordance with a preferred embodiment
14 of the invention:

15 One kg of pre-filtered Formez-50 polyester resin (Hagalil
16 Company, Ashdod, Israel) is dehydrated and degassed under
17 vacuum at 60°C. 600 grams of the degassed material is mixed
18 with 1.4 grams of di-butyl-tin-diluarate (Aldrich) and
19 degassed at room temperature for 2 hours. 30 grams of the
20 resulting material, 3.15 grams of RTV Silicone 118 (General
21 Electric) and 4.5 grams of Polyurethane cross-linker, DESMODUR
22 44V20 (Bayer) are stirred together. A 100 micrometer layer of
23 the material is coated over the preceding layer using a No. 3
24 wire rod with one or several passes, under clean conditions,
25 preferably, class 100 conditions. The coating may be cured for
26 two hours at room temperature under a clean hood to form a
27 polyurethane layer or may be cured later, together with other
28 layers.

29 In accordance with a second preferred embodiment of the
30 invention, layer 111 is formed by the following process:

31 1) 100g of Hi-Temp 4051 EP (Zeon) acrylic resin is mixed
32 with 2g NPC-50 crosslinker (Zeon) and 3g sodium stearate and
33 dissolved in toluene to give a solution of 15% non-volatile
34 solids. Optionally, about 44g of carbon black Pearls 130
35 (Cabot) is added.

36 2) A thin layer of the solution is coated onto the
37 barrier layer and dried. This process is repeated several

1 times until a thickness of preferably 100 micrometers is
2 achieved.

3 The layer has a Shore A hardness of about 20-24 without
4 carbon black and about 42-45 with carbon black. Softer
5 materials are also suitable; however, substantially harder
6 materials do not adhere well to the drum surface. The acrylic
7 material may be replaced by other soft elastomer materials
8 such as soft nitrile rubber, as described in detail in PCT/NL
9 95/00188, the disclosure of which is incorporated herein by
10 reference.

11 Layer 111 which is thus formed should have a resistance
12 of the order of about 10^8 ohm-cm, good thermal stability at
13 the working temperature of the blanket surface, which is
14 preferably about 100°C or less.

15 The function of the conforming layer is to provide good
16 conformation of the blanket to the image forming surface (and
17 the image on the image forming surface) at the low pressures
18 used in transfer of the image from the image forming surface
19 to the blanket. The layer should have a Shore A hardness
20 preferably of between 25 and 65, more preferably between 40
21 and 50, more preferably between about 42 and 45. While a
22 thickness of 100 micrometers is preferred, other thicknesses,
23 between 50 micrometers and 300 micrometers can be used, with
24 75 to 125 micrometers being preferred. Too hard a layer can
25 cause incomplete transfer to the intermediate transfer member
26 of very small printed areas, such as single dots. Too soft a
27 layer can cause difficulty in removal of a paper substrate (to
28 which the image is transferred from the intermediate transfer
29 member) from the intermediate transfer member. It is often
30 difficult to achieve optimum transfer and substrate removal.

31 This problem is partially solved by dividing conforming
32 layer 111 into a number of sub-layers of different hardnesses.
33 The sub-layers may have the same thickness or different
34 thicknesses. This embodiment is based on the discovery that
35 paper removal appears to be most sensitive to the hardness of
36 the upper portion of the layer and that transfer of the image
37 to the transfer blanket is less sensitive to the hardness of
38 this portion of the layer.

1 Such sub-layers of varying hardness and thickness may be
2 formed in generally the same way as described above with
3 respect to the second method of forming layer 111, with the
4 hardness of the sub-layers being varied by changing the
5 proportion of carbon black. The softer and harder sub-layers
6 are laid down separately to form the total desired thickness
7 of conforming layer 111.

8 It was found that varying the hardness of the harder
9 layer between 42 and 55 Shore A, the soft layer hardness
10 between 20 and 42 and the thickness of the harder layer
11 between 15 and 30 micrometers (the total layer thickness
12 remaining at 100 micrometers) gave improved paper release
13 properties. The image transfer was improved mainly for the
14 experiments in which the hard layer was thinner and the soft
15 layer softer. The layers are preferably formed such that the
16 harder layer is closest to the upper portion of the layer, and
17 the softer layer closer to the body 116 of the intermediate
18 transfer member. It is believed that thinner hard layers
19 and/or softer soft layers will give even better results.

20 In a preferred embodiment of the invention, conforming
21 layer 111 is overcoated with release layer 109, which is
22 formed by the following process, according to one preferred
23 embodiment of the invention. 12 grams of RTV silicone 236 (Dow
24 Corning) release material preferably diluted with 2 grams of
25 Isopar L (Exxon) and 0.72 grams of Syl-off 297 (Dow Corning)
26 are mixed together. A wire rod (bar No. 1) coating system is
27 used, with between one and six passes, under clean conditions
28 to achieve a preferably 3-15 micrometer, more preferably 6-12
29 and most preferably 8-10 micrometer release layer thickness.
30 In practice the release layer is about 8 micrometers thick.
31 The material is cured at room temperature for 2 hours followed
32 by 140°C for two hours. The cured release material has a
33 resistivity of approximately 10^{14} to 10^{15} ohm-cm (or a lesser
34 value if a conductive material is added).

35 According to a second preferred embodiment of the
36 invention, release layer 109 is formed of a condensation type
37 silicone release layer. In general such materials are not used
38 for thin layers, such as the approximately 3-15 micrometer,

1 preferably 8 micrometer layer generally desired for the
2 present invention. However, it has been discovered that when a
3 larger than normal amount of catalyst is added and when the
4 material is preferably cured at an elevated temperature, such
5 materials do cure, even in very thin layers. While generally
6 0.1%-0.5% of catalyst is normally used, the present invention
7 uses 0.5%-2.5% catalyst preferably greater than 1%. In the
8 preferred embodiment given below, the amount of catalyst is
9 about 2.5 times the maximum normally used.

10 It has been found that intermediate transfer members
11 using such materials for release layer 109 have generally
12 longer operating lifetime and generally better printing
13 characteristics than blankets formed with release layers
14 according to the prior art. This is also true of blankets in
15 which the image transfer portion is formed directly onto the
16 body as in the prior art. In a preferred embodiment of the
17 invention only reactive silicone compounds are used in the
18 formation of layer 109 with as small an amount of such
19 compounds as silicone oils being present, less than 10%,
20 preferably less than 5% and even more preferably less than 1%
21 of silicone oils being present. Furthermore, it has been found
22 that such materials are generally most useful when they have
23 no fillers, less than 0.1%, or only a small amount of fillers,
24 less than 4%.

25 Useful materials have been found to include
26 diorganopolysiloxanes terminated at both chain ends with
27 diorganohydroxysilyl groups bonded to terminal silicone atoms
28 work especially well. Finally, it has been found that a
29 mixture of such compounds gives better overall results than
30 individual compounds.

31 In a preferred embodiment of the invention the release
32 layer 109 is prepared by the following process:

33 a) 12 Grams of RTV 41 (general Electric) is mixed with 16
34 grams of RTV 11 (General Electric) with the fillers removed
35 (50% solids) and a 250 microliters of an 8:2 solution of
36 Stannous octoate (Sigma) in Isopar H (EXXON).

1 b) The mixture is coated onto the conforming layer 111 of
2 the blanket using a wire rod and is immediately introduced
3 into an oven at 140°C for curing for two hours.

4 The filler material is preferably removed from RTV 11 by
5 dissolving 120 gm of RTV 11 in 80 grams of an Isopar H/Hexane
6 mixture (1:1). The solution is centrifuged at 7000 RPM for one
7 hour.

8 The resulting material has about 25% filler material,
9 comprising mostly calcium carbonate. A release layer with less
10 filler can be prepared by removing the filler material from
11 the RTV 41 as well.

12 It has been found that using the individual components of
13 the mixture, namely RTV 41 and RTV 11 by themselves to form
14 release layer 109 also gives an improvement over the prior
15 art. However, the mixture appears to give a greater
16 improvement.

17 According to a third preferred embodiment, a crosslinker,
18 such as ethyl silicate and conductive material, such as carbon
19 black or anti-static compounds such as CC-42 (Witco) are added
20 to the release layer 109 of the second preferred embodiment of
21 the invention. The added crosslinker provides for further
22 improvement of the mechanical properties and very thin film
23 polymerization of the release layer, while the added
24 conductive material provides for improved electrical
25 characteristics and print quality.

26 Primers, such as (3-glycidoxypropyl)trimethoxysilane
27 (ABCR, Germany) and 1205 (Dow Corning), are used to provide
28 for maximum adhesion of the release layer 109 to the
29 conforming layer 111.

30 The release layer 109 of this embodiment is prepared as
31 follows:

32 a) 100 gm RTV 11 (GE) are dissolved in 100 gm
33 hexane/isopar-H (50:50 by wt.) mixture, 100 gm RTV 41 (GE) are
34 dissolved in 100 gm hexane/isopar-H mixture, and both mixtures
35 are centrifuged at 7000 RPM for 70 min. The liquid is
36 decanted, percent solids determined, and the precipitated
37 solids, comprising filler material, in this case calcium
38 carbonate, from the centrifugation is discarded.

1 b) An amount of RTV 11 solution which provides 60 gm RTV
2 11 solids is mixed with an amount of RTV 41 solution which
3 provides 40 gm RTV 41 solids. To this mixture is added 5 gm
4 ethyl silicate (Chordip) and 1 gm Ketjenblack 600 carbon black
5 (Akzo). The mixture is dispersed with a high shear mixer for
6 10 min.

7 c) Before the conforming layer 111 of the ITM is coated
8 with the silicone release layer 109, the conforming layer 111
9 must be coated with the appropriate primers to provide maximum
10 adhesion. Using acrylic rubber as the soft layer of the
11 conforming layer 111, it is first coated with a thin layer of
12 (3-glycidoxypyl)trimethoxysilane (ABCR, Germany). The
13 primer coated blanket is heated at 50 °C for 5 min. The first
14 primer layer is then coated with a second primer layer of 1205
15 (Dow Corning), and is left at room temperature for 15 min.

16 d) To 10 gm of the above-described release material is
17 added 350 microliters of a stannous octoate/isopar-H mixture
18 (4:1 by weight). A dry film thickness of about 7 microns is
19 achieved by 2-3 coatings with a wire rod. Immediately after
20 coating the transfer-portion carrying substrate 104 with the
21 release layer 109, it is placed in an oven at 140 °C for two
22 hours.

23 Once the formation of image transfer portion 104 on
24 substrate 200 is complete, the transfer-portion carrying
25 substrate is fed to blanket-forming apparatus 180 along the
26 direction indicated by arrow 205. An edge of transfer portion
27 104 is separated from surface 202 of substrate 200 and
28 collected by a carrier drum 220, which preferably includes a
29 drum having a smooth, preferably metal, surface 222. Surface
30 222 is preferably formed of very smooth, chrome-coated,
31 stainless steel. Drum 220 preferably rotates in the direction
32 indicated by arrow 210, at a suitable rate, such that surface
33 222 moves substantially at the same linear velocity as
34 substrate 200.

35 As shown in Fig. 3, release layer 109 is the upper-most
36 layer coated onto surface 202 of substrate 200 and, thus,
37 layer 109 interfaces surface 222 of drum 220. The generally
38 smooth release layer 109 will temporarily attach itself by a

1 vacuum action to the smooth, metal, surface 222 of drum 220,
2 thereby assisting in the transfer of portion 104 from
3 substrate 200 to intermediate carrier 220, at a first transfer
4 region 203.

5 As further shown in Fig. 3, the pre-fabricated body
6 portion 116 is fed into a second transfer region 206, between
7 intermediate carrier drum 220 and a lamination drum 212 having
8 a surface 214, along the direction indicated by arrow 215.
9 Drum 212 rotates in a sense opposite that of drum 220, as
10 indicated by arrow 217, such that there is substantially zero
11 relative motion between surfaces 222 and 214 at region 206.

12 At second transfer region 206, image transfer portion 104
13 attaches itself to portion 116 and is thus removed from
14 surface 222 of drum 220. Portion 104 is laminated with body
15 portion 116, resulting in the formation of the integrated,
16 multi-layered, image transfer blanket 100.

17 Lamination of the two portions of blanket 100 is
18 preferably aided by heat and pressure applied by drums 220 and
19 212. In a preferred embodiment of the invention, drum 220 is
20 heated to a temperature range of between 90°C and 130°C.
21 Additionally, drum 212 may also be heated. This temperature
22 range should be suitable for aiding bonding between transfer
23 portion 104 and body portion 116, when the materials describes
24 above are used. Bonding is achieved by the uncured conductive
25 layer 115 which becomes highly adhesive in response to the
26 heat applied thereto during lamination.

27 As mentioned above, conductive layer 115 is preferably
28 not cured prior to lamination. However, the layers in transfer
29 portion 104, i.e. layers 109, 111 and 114, may be cured before
30 lamination, if the conductive layer is formed as part of body
31 portion 116, prior to lamination, as described above.
32 Nevertheless, if conductive layer 115 is included is formed as
33 part of image transfer portion 104, prior to lamination, all
34 the layers in portion 104 are preferably not cured before
35 lamination.

36 If layer 118 is made conductive (and layer 115 is
37 omitted) then a thin layer of the lacquer of the type used for

1 layer 115 or a glue or a primer may be used over layer 118 to
2 enhance the lamination process.

3 Once portions 104 and 116 are laminated, the blanket is
4 cured, for example, using a curing device 225. The cured
5 layers include the layers which were not cured prior to
6 lamination, particularly conductive layer 115 and, optionally,
7 uncured layers in image transfer portion 104. Curing device
8 225 preferably includes a heater as is well known in the art.
9 This completes the formation of multi-layered image transfer
10 blanket 100. Alternatively, strips of blanket may be cured in
11 an oven heated to between 110°C (for about one hour) and 180°C
12 (for about four minutes).

13 Reference is now made to Fig. 4 which schematically
14 illustrates a cross-section of an image transfer blanket 300
15 having a body portion 216 and an image transfer portion 204,
16 constructed in accordance with another, preferred, embodiment
17 of the present invention. Blanket 300 preferably includes all
18 of the layers described above with reference to Figs. 1-3,
19 i.e. layers 109, 111, 115, 118, 120, 122 and, optionally,
20 adhesive (or soft) layer 126 of blanket 100 (Fig. 2C).
21 However, in contrast to the integrated blanket 100, image
22 transfer portion 204 of blanket 300 is a self-supporting layer
23 which is not necessarily laminated with body portion 216.
24 Image transfer portion 204 may be permanently or removably
25 attached to body portion 216, using a suitable adhesive, or
26 portion 204 may be used in conjunction with body portion 216
27 without being attached thereto, for example, as described in
28 detail below. To obtain these features of blanket 300, the
29 active layers of image transfer portion 204 are preferably
30 formed on a thin (including at least the range of 30
31 micrometers to preferably less than 12 micrometers, with
32 physical stability defining the lower limit of the range)
33 intermediate base layer 250, which is formed of a relatively
34 non-compliant material such as Kapton. Base layer 250 does not
35 contaminate the other layers in transfer portion 204, during
36 formation thereof, and has sufficient strength to support the
37 other layers in portion 204. However, base layer 250 does not
38 obviate the need for body portion 216 which provides, inter

1 alia, high pressure resilience required by multi-layered
2 blanket 300. It is believed that base layer 250 does
3 not substantially affect the operation of body portion 216.

4 It should be noted that failure of intermediate transfer
5 blankets is caused primarily by failure of the release
6 properties of layer 109. Although, eventually, failure of the
7 blanket may also be caused by failure of the resilient
8 properties of body portion 116, the resilient properties of
9 the body portion last much longer, at least several times
10 longer, than the release properties of the release layer.
11 Thus, the present invention provides a mechanism for replacing
12 only the image transfer portion of blanket 300, as described
13 below.

14 Reference is now made to Fig. 5 which schematically
15 illustrates an image transfer member 230 using an image
16 transfer blanket, such as blanket 300 of Fig. 4, in which
17 transfer portion 204 is separate from body portion 216. Body
18 portion 216 of blanket 300 is mounted on a drum 240 which
19 rotates in the direction indicated by arrow 235. Body portion
20 216 may be mounted in a manner similar to that of blanket 100
21 in the embodiment of Fig. 1, such that only one end of the
22-body portion is secured to a fastener member (not shown) which
23 would be situated at the location indicated by reference
24 numeral 310.

25 In accordance with the present invention, image transfer
26 member 230 further includes apparatus for replacing image
27 transfer portion 204 of image transfer blanket 300 without
28 replacing body portion 216. The replacement apparatus
29 preferably includes a transfer portion supply member 260,
30 preferably a cassette containing a predetermined length of
31 new, i.e. unused, transfer portion 204, and a take up member
32 270, preferably a cassette, which collects used transfer
33 portion 204. Transfer portion 204 is preferably tightly
34 stretched over body portion 216, between an aperture 265 of
35 supply member 260 and an aperture 275 of take-up member 270.
36 To ensure that a suitable tension is maintained in transfer
37 portion 204, the transfer portion is preferably locked and/or
38 tensioned at apertures 265 and 275 using any suitable

1 lock/tension devices (not shown), preferably electrically
2 controlled devices. Alternatively, a take-up roller 227 and a
3 pay-out roller 278 are tensioned to assure desired tension in
4 the exposed part of portion 204.

5 In a preferred embodiment of the invention, take-up
6 member includes a motor-operated take-up roller 277 which
7 collects the used transfer portion 204. Preferably, upon
8 command from a controller (not shown), a predetermined length
9 of transfer portion 204 is collected by take-up roller 277, so
10 as to replace the transfer portion on the entire surface of
11 body portion 216. The controller preferably also controls
12 deactivation of the lock/tension devices at apertures 265 and
13 275, before replacement of the transfer portion, and
14 reactivation of the lock/tension devices upon completion of
15 the replacement process.

16 It should be noted that portion 204 is much thinner than
17 body portion 216 and, thus, a longer length of transfer
18 portion may be contained in supply member 260, in comparison
19 to prior art mechanisms which replaced the entire thickness of
20 the blanket. This enables a larger number of replacements of
21 portion 204 before the entire supply of transfer portion 204
22 in member 260 is used.

23 Other details of preferred imaging apparatus used in
24 conjunction with the present invention are described in PCT/NL
25 95/00188, the disclosure of which is incorporated herein by
26 reference.

27 It should be understood that some aspects of the inven-
28 tion are not limited to the specific type of image forming
29 system used and some aspects of the present invention are also
30 useful with any suitable imaging system which forms a liquid
31 toner image on an image forming surface and, for some aspects
32 of the invention, with powder toner systems. Some aspects of
33 the invention are also useful in systems such as those using
34 other types of intermediate transfer members such as belt or
35 continuous coated drum type transfer members. Some aspects of
36 the invention are suitable for use with offset printing
37 systems. The specific details given above (and in the
38 documents incorporated herein by reference) for the image

1 forming system are included as part of a best mode of carrying
2 out the invention; however, many aspects of the invention are
3 applicable to a wide range of systems as known in the art for
4 electrophotographic and offset printing and copying.

5 It will be appreciated by persons skilled in the art that
6 the present invention is not limited by the description and
7 example provided hereinabove. Rather, the scope of this
8 invention is defined only by the claims which follow:

CLAIMS

- 1
2 1. A method of producing a multi-layered image transfer
3 blanket including a body portion and an image transfer
4 portion, the image transfer portion having an image transfer
5 surface and a back surface, comprising:
6 forming the image transfer portion on a carrier
7 substrate; and
8 transferring the image transfer portion onto the body
9 portion such that the back surface of the image transfer
10 portion faces the body portion.
11
- 12 2. A method according to claim 1 wherein the image transfer
13 portion is formed on the carrier substrate such that the back
14 surface of the image transfer portion faces the carrier
15 substrate.
16
- 17 3. A method according to claim 1 or claim 2 wherein
18 transferring the image transfer portion comprises:
19 transferring the image transfer portion to a moving
20 carrier surface, such that at least a portion of the image
21 transfer surface is in contact with the moving surface; and
22 laminating the image transfer portion onto the body
23 portion such that the back surface of the image transfer
24 portion faces the body portion.
25
- 26 4. A method according to any of the preceding claims and
27 further comprising curing at least one of the layers in said
28 multi-layered blanket after transferring the image transfer
29 portion.
30
- 31 5. A method according to claim 4 wherein the image transfer
32 blanket comprises a polymer layer interfacing the back surface
33 of the image transfer portion and wherein curing at least one
34 of the layers comprises curing the polymer layer after
35 laminating the image transfer portion onto the body portion.
36
- 37 6. A method according to claim 5 wherein the polymer layer
38 is a conductive layer.

1

2 7. A method according to claim 5 or claim 6 wherein the
3 polymer layer is part of the body portion.

4

5 8. A method according to claim 5 or claim 6 wherein the
6 polymer layer is part of the image transfer portion.

7

8 9. A method according to any of claims 4-7 wherein the image
9 transfer portion comprises a release layer at the image
10 transfer surface and a conforming layer and wherein curing at
11 least one layer comprises curing the release layer and the
12 conforming layer before laminating the image transfer portion
13 to the body portion.

14

15 10. A method according to any of claims 4-8 wherein the image
16 transfer portion comprises a release layer at the image
17 transfer surface and a conforming layer and wherein curing at
18 least one layer comprises curing the release layer and the
19 conforming layer after laminating the image transfer portion
20 to the body portion.

21

22 11. A method according to any of the preceding claims wherein
23 forming the image transfer portion comprises:

24 coating the carrier substrate with a conforming layer.

25

26 12. A method according to any of claims 1-10 wherein forming
27 the image transfer portion comprises:

28 coating the carrier substrate with a barrier layer.

29

30 13. A method according to any of claims 1-10 wherein forming
31 the image transfer portion comprises:

32 coating the carrier substrate with a conductive layer.

33

34 14. A method according to claim 13 wherein forming the image
35 transfer portion comprises:

36 coating the conductive layer with a barrier layer.

37

- 1 15. A method according to claim 12 or claim 14 wherein
2 forming the image transfer portion comprises:
3 coating the barrier layer with a conforming layer.
- 4 16. A method according to claim 14 wherein forming the image
5 transfer portion comprises:
6 coating the barrier layer with a conductive layer.
- 7
- 8 17. A method according to claim 13 or claim 16 wherein
9 forming the image transfer portion comprises:
10 coating the conductive layer with a conforming layer.
- 11
- 12 18. A method according to any of claims 9-11, 15 or 17
13 wherein the conforming layer comprises a plurality of layers
14 of different hardnesses.
- 15
- 16 19. A method according to any of claims 11, 15, 17, or 18
17 wherein forming the image transfer portion comprises:
18 overcoating the conforming layer with a release layer.
- 19
- 20 20. A method according to any of the preceding claims wherein
21 the release layer comprises a layer of condensation type
22 silicone.
- 23
- 24 21. A method according to claim 20 wherein the condensation
25 type silicone contains less than 4% filler material.
- 26
- 27 22. A method according to claim 20 wherein the condensation
28 type silicone contains less than 1% filler material.
- 29
- 30 23. A method according to claim 20 wherein the condensation
31 type silicone contains less than 0.1% filler material.
- 32
- 33 24. A method according to any of claims 20-23 wherein the
34 release layer has a thickness of less than 1 mm.
- 35
- 36 25. A method according to any of claims 20-23 wherein the
37 release layer is less than 200 micrometers thick.
- 38

1 26. A method according to any of claims 20-23 wherein the
2 release layer is less than 100 micrometers thick.

3

4 27. A method according to any of claims 20-23 wherein the
5 layer is less than 50 micrometers thick.

6

7 28. A method according to any of claims 20-23 wherein the
8 layer is between about 3 and about 15 micrometers thick.

9

10 29. An image transfer member suitable for the transfer of
11 toner images and having an outer release layer of a
12 condensation type silicone.

13

14 30. An image transfer member according to claim 29 wherein
15 the layer has a thickness of less than 1 mm.

16

17 31. An image transfer member according to claim 29 wherein
18 the layer is less than 200 micrometers thick.

19

20 32. An image transfer member according to claim 29 wherein
21 the layer is less than 100 micrometers thick.

22

23 33. An image transfer member according to claim 29 wherein
24 the layer is less than 50 micrometers thick.

25

26 34. An image transfer member according to claim 29 wherein
27 the layer is between about 3 and about 15 micrometers thick.

28

29 35. An image transfer member according to any of claims 29 to
30 34 wherein the outer release layer contains less than 10%
31 silicone oil.

32

33 36. An image transfer member according to any of claims 29 to
34 34 wherein the outer release layer contains less than 5%
35 silicone oil.

36

1 37. An image transfer member according to any of claims 29 to
2 34 wherein the outer release layer contains less than 1%
3 silicone oil.

4

5 37. An image transfer member according to any of claims 29 to
6 34 wherein the outer release layer contains essentially no
7 silicone oil.

8

9 38. A method according to any of claims 29 to 37 wherein the
10 condensation type silicone contains less than 4% filler
11 material.

12

13 39. A method according to any of claims 29 to 37 wherein the
14 condensation type silicone contains less than 1% filler
15 material.

16

17 40. A method according to any of claims 29 to 37 wherein the
18 condensation type silicone contains less than 0.1% filler
19 material.

20

21 41. An image transfer member according to any of claims 29 to
22 40 wherein the outer release layer contains added crosslinker.

23

24 42. An image transfer member according to any of claims 29 to
25 41 wherein the outer release layer contains added catalyst.

26

27 43. An image transfer member according to any of claims 29 to
28 42 wherein the outer release layer contains added conductive
29 material.

30

31 44. An image transfer member according to any of claims 29 to
32 43 wherein adhesion of the outer release layer to the image
33 transfer member is enhanced utilizing primer.

34

35 45. Apparatus for producing a multi-layered image transfer
36 blanket including a body portion and an image transfer
37 portion, the image transfer portion having an image transfer
38 surface and a back surface, comprising:

1 a carrier substrate having the image transfer portion
2 formed thereon such that the back surface of the image
3 transfer portion faces the carrier substrate and is releasable
4 therefrom; and

5 a moving carrier surface, in contact with a portion of
6 the image transfer surface, which receives the image transfer
7 portion from the carrier substrate, at a first transfer
8 region, and laminates the image transfer portion onto the body
9 portion, at a second transfer region, with the back surface of
10 the image transfer portion facing the body portion.

11

12 46. Apparatus according to claim 45 and further comprising a
13 curing device which cures at least one of the layers in said
14 multi-layered blanket.

15

16 47. An image transfer blanket comprising:

17 a transfer surface adapted to receive already formed
18 images; and

19 a conforming layer substantially immediately beneath the
20 release surface which comprises a plurality of sub-layers each
21 having a Shore A hardness of less than 80.

22

23 48. An image transfer blanket according to claim 47 wherein
24 the sub-layers each have a shore A hardness of less than 70.

25

26 49. An image transfer blanket according to claim 47 wherein
27 the sub-layers each have a shore A hardness of less than 60.

28

29 50. An image transfer blanket according to any of claims 47-
30 49 wherein the sub-layers comprise at least two sub-layers, a
31 relatively harder one of said sub-layers being situated
32 between the release surface and a relatively softer one of
33 said sub-layers.

34

35 51. An image transfer blanket according to claim 50 wherein
36 the relatively softer sub-layer has a Shore A hardness of less
37 than 42.

38

1 52. An image transfer blanket according to claim 50 wherein
2 the relatively softer sub-layer has a Shore A hardness of less
3 than 35.

4

5 53. An image transfer blanket according to claim 50 wherein
6 the relatively softer sub-layer has a Shore A hardness of less
7 than 25.

8

9 54. An image transfer blanket according to any of claims 50
10 to 53 wherein the relatively harder sub-layer has a Shore A
11 hardness of greater than 42.

12

13 55. An image transfer blanket according to any of claims 50
14 to 53 wherein the relatively harder sub-layer has a Shore A
15 hardness of greater than 50.

16

17 56. An image transfer blanket according to any of claims 50
18 to 55 wherein the ratio of thickness of the relatively hard
19 sub-layer to the thickness of the relatively softer sub-layer
20 is about 1:4.

21

22 57. An image transfer blanket comprising:

23 a body portion including a layer of resilient material;
24 and

25 a multi-layered transfer portion having an image transfer
26 surface and including a supporting base layer which is formed
27 of a substantially non-compliant material,

28 wherein the supporting base layer of the transfer portion
29 interfaces the body portion.

30

31 58. An image transfer blanket according to claim 57 wherein
32 the supporting base layer comprises a layer of Kapton.

33

34 59. A method of producing a multi-layered image transfer
35 blanket comprising:

36 forming a multi-layered image transfer portion having an
37 image transfer surface and a supporting base layer, the base

1 layer being formed of a substantially non-compliant material;
2 and
3 attaching the image transfer portion to a body portion
4 including a layer of substantially resilient material,
5 wherein the supporting base layer of the transfer portion
6 interfaces the body portion.

7
8 60. An intermediate transfer member, which receives a toner
9 image from an imaging surface and from which it is
10 subsequently transferred, comprising:

11 a drum; and

12 an image transfer blanket mounted on the drum, the image
13 transfer blanket comprising:

14 a body portion including a layer of resilient
15 material; and

16 a multi-layered transfer portion having an image
17 transfer surface which receives the toner image and a
18 supporting base layer which is formed of a substantially
19 non-compliant material,

20 wherein the supporting base layer of the transfer portion
21 interfaces the body portion.

22

23 61. An intermediate transfer member according to claim 60
24 wherein the supporting base layer comprises a layer of Kapton.

25

26 62. An intermediate transfer member, which receives a toner
27 image from an imaging surface and from which it is subse-
28 quently transferred, comprising:

29 a drum;

30 a resilient blanket body mounted circumferentially on the
31 surface of the drum and having a functional length;

32 a sheet of image transfer material having first and
33 second ends and having a length equal to at least twice the
34 functional length of the blanket body;

35 a transfer material supply member associated with the
36 first end of the sheet; and

37 a transfer material take-up member associated with the
38 second end of the sheet,

1 wherein an appropriate length of the sheet is stretched
2 between the supply member and the take-up member, over the
3 functional length of the blanket body.

4

5 63. An intermediate transfer member according to claim 62
6 wherein a predetermined length of used-up sheet is taken-up by
7 the take-up member and replaced with approximately the same
8 length of unused sheet which is supplied the supply member.

9

10 64. A carrier substrate having formed thereon a multi-layered
11 image transfer arrangement, the image transfer arrangement
12 comprising a back surface and an image transfer surface,
13 wherein the back surface of the image transfer arrangement
14 faces the carrier substrate and is removably attached thereto.

1/4

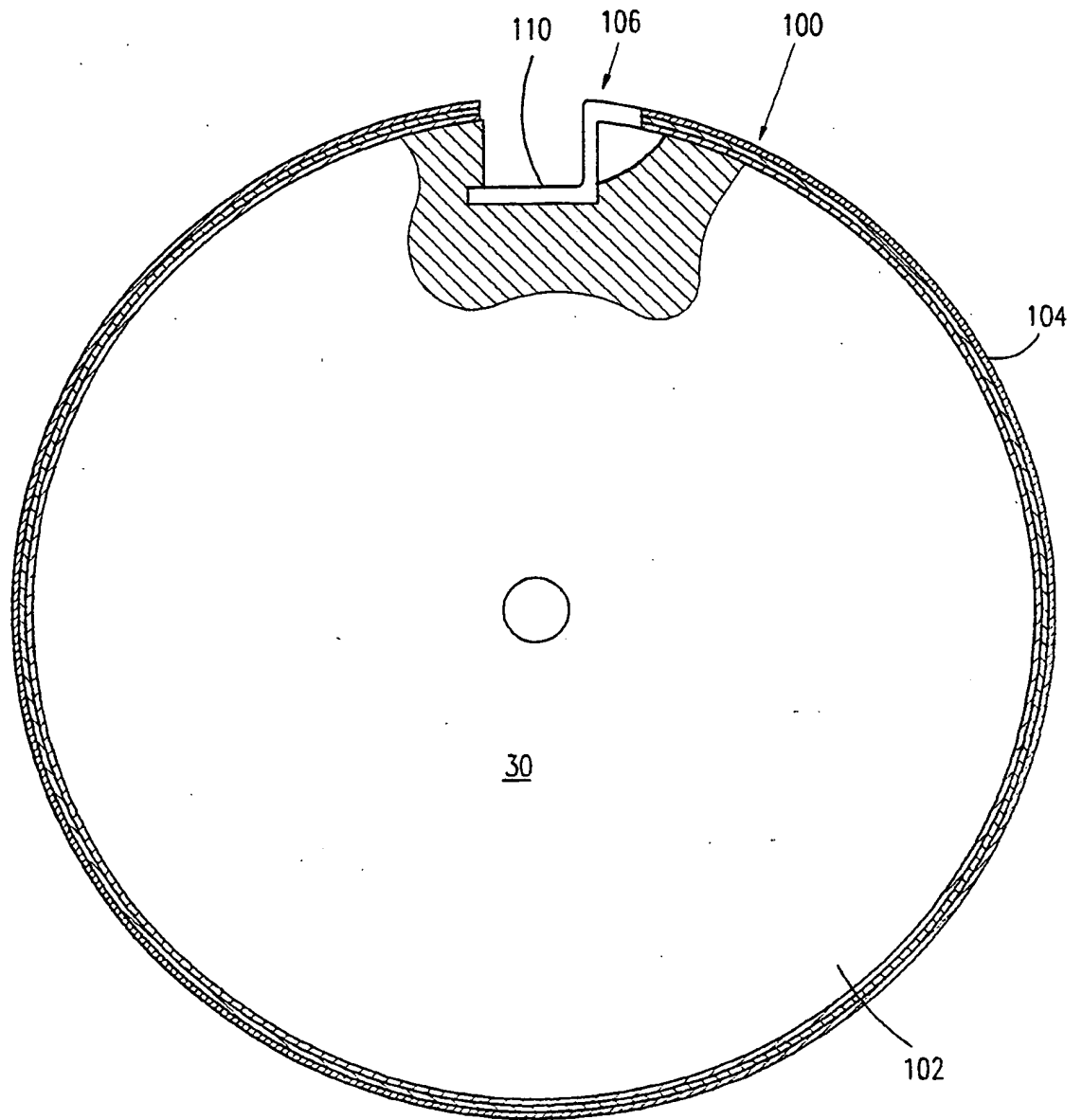


FIG. 1

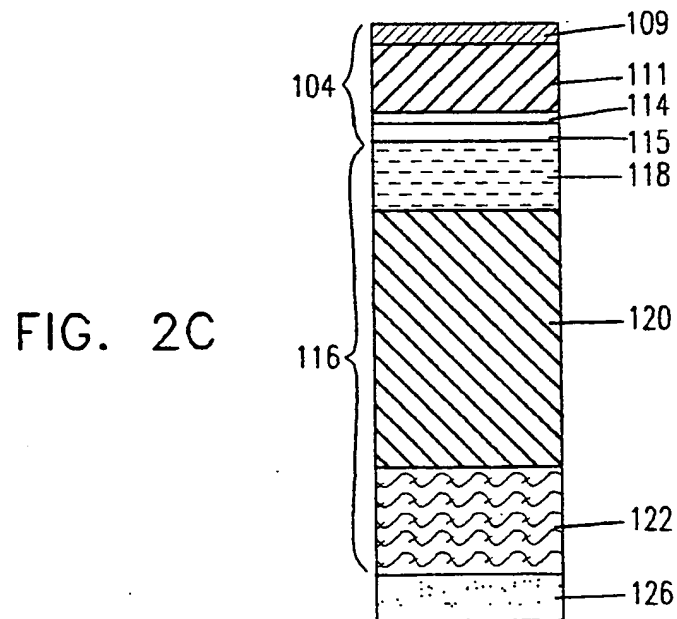
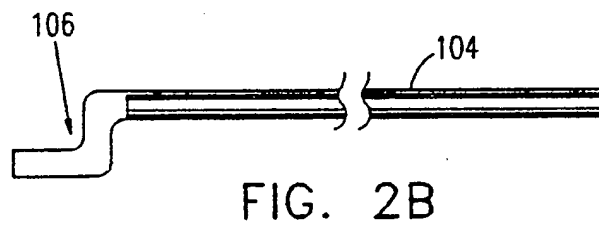
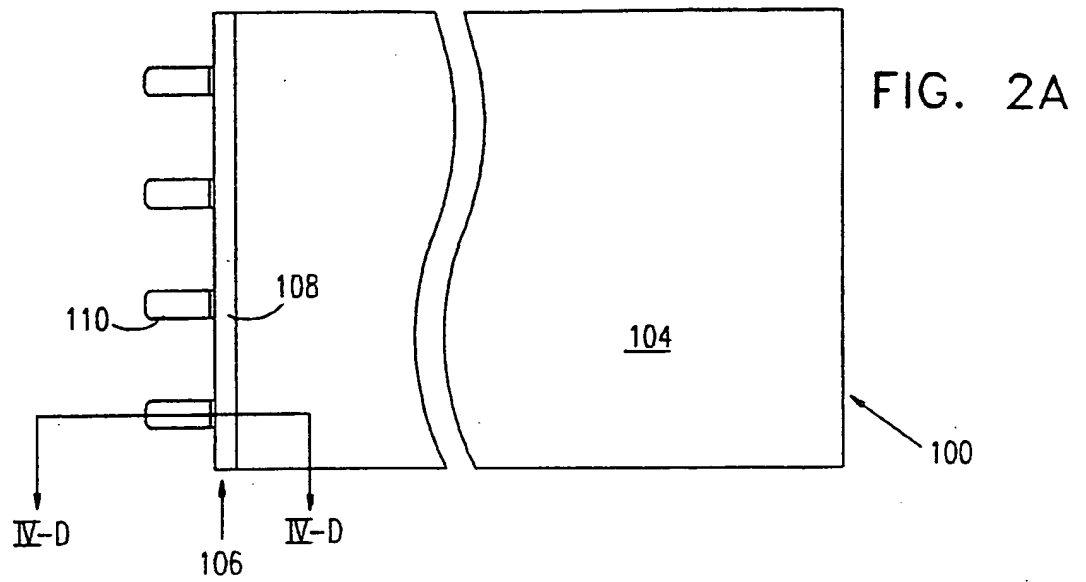


FIG. 3

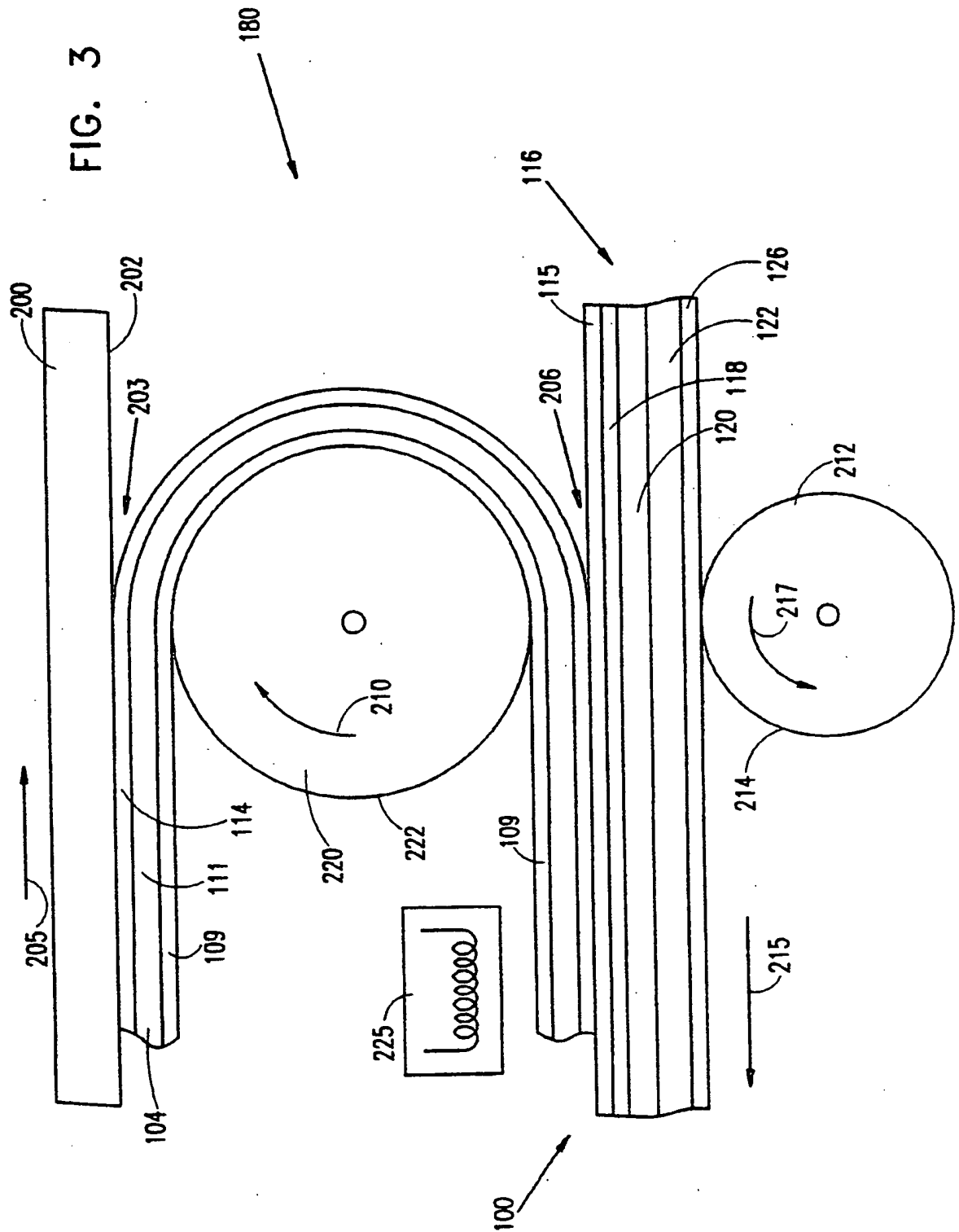


FIG. 4

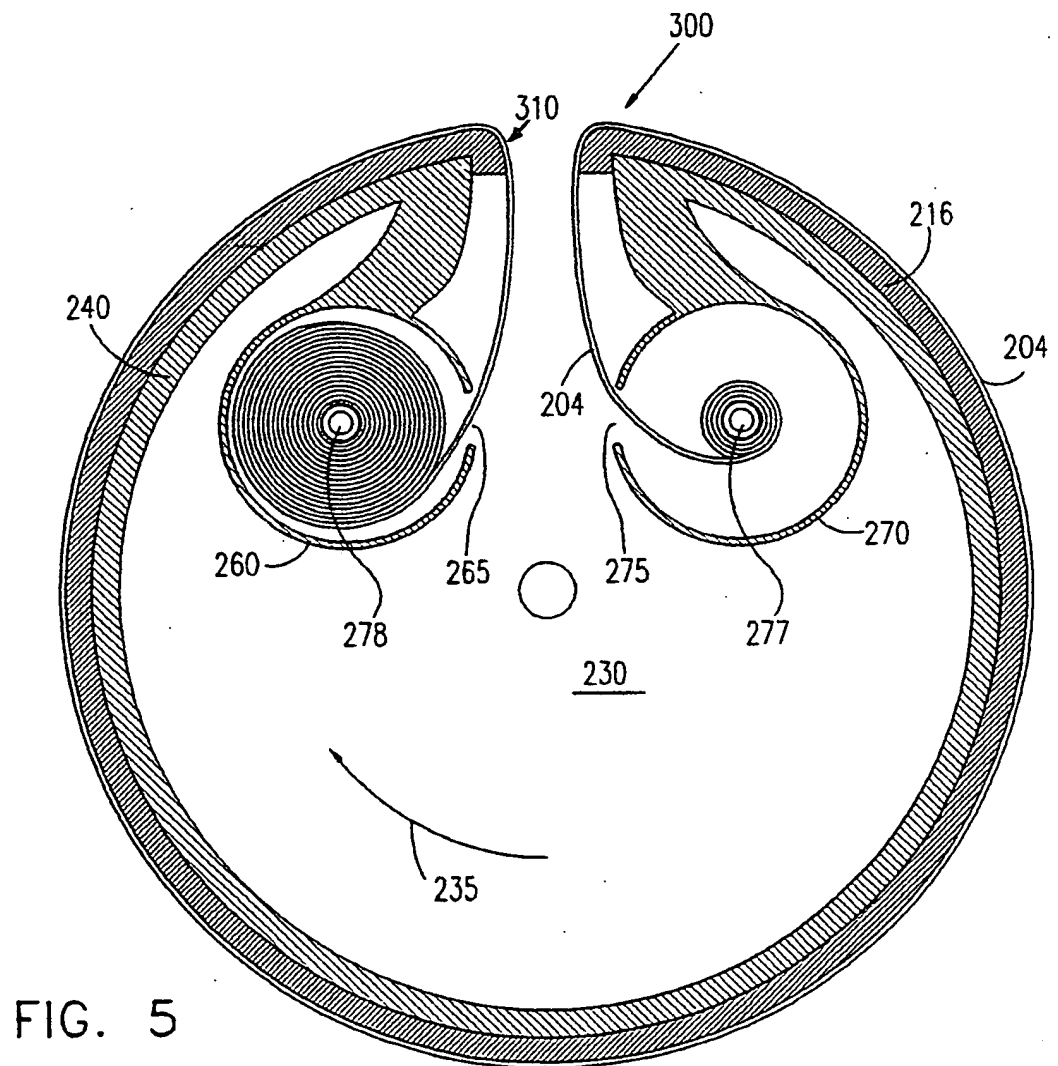
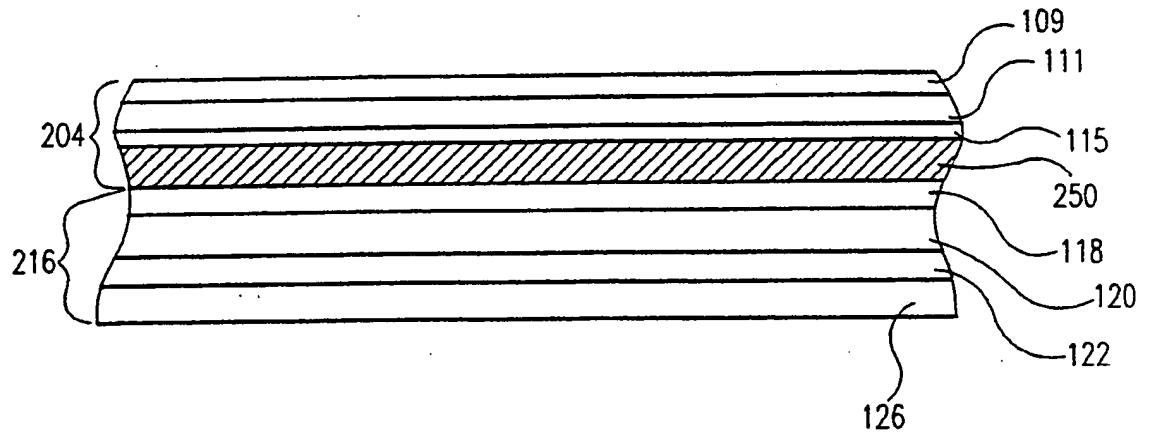


FIG. 5